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PROSPECTS FOR THE DEVELOPMENT OF INFORMATION TECHNOLOGIES IN THE MODERN MANAGEMENT SYSTEM

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Abstract. Information technology is the subject of wide attention in scientific research - technical, managerial, legal. In general, the term "information technology" covers a large number of different automated tools that are combined on the basis of interaction with information, that is, its creation, processing, storage and transmission.

The interest in this topic is due to the fact that new information technologies are constantly appearing that surpass the previous generation in certain indicators, creating the need for research on the applicability of existing regulatory mechanisms to the new generation. At the same time, an insufficient number of works on modern information technologies in the management system is noted.

The purpose of the study is to study the processes of interaction between information technology as a complex of software and hardware, and management as a management tool, as well as the definition of criteria that characterize information technology as a modern management category to reflect the level of their development and penetration into the system of modern management of economic systems.

Research methodology - analysis of information technology sources in the context of modern management.

The article gives a classification of information technologies, which most fully reflects the relationship between information technologies and the solution of managerial tasks, proposes the introduction of new criteria for assessing the state of information technologies in the management system, substantiates the creation of separate Information Technology Development Index in the future.

Keywords: information technologies, information resources, management, business processes.

Introduction. Market relationships in the economy and scientific and technological progress have significantly accelerated the emergence of the latest developments in the field of information technology in all areas of socio-economic life of society. The concept of informatization as a process of implementing information technology has entered the scientific literature. The relevance of the research topic is revealed in three interrelated aspects: managerial, economic and rule-making.

The managerial aspect is manifested in the fact that modern information technologies are an integral part of key decision-making systems for business entities, states and integration associations. Decision-making on the use of a particular information technology to gain a competitive advantage sets a challenge for management to change the organization's internal environment. Decisions to perform these tasks lead to transformation that can make an economic entity, state or integration association a leader or to worsen its position, if the wrong development way is chosen. Modern information technologies allow achieving transparency in making managerial decisions due to the introduction of electronic document management. The use of information technology allows analyzing large amounts of data that can be used for management purposes, without significant errors that can be caused by the human factor.

The economic aspect is due to the fact that information technology because of its use in management systems, affects the employee's performance. This effect is achieved due to the optimization of control systems, which frees them from a number of routine operations that take a lot of time. In modern factories, using the means of information transfer, production indicators almost instantly and without distortion of information get to the responsible, which eliminates the need for additional verification of possible errors related to the human factor.

In the context of globalization, any business entity in any country can become a company's counterparty, which requires a high level of information technology development to interact with it. The use of modern means of communication allows us to solve these issues. At the state level, this means that it is necessary to create such regulatory standards that will accelerate the development of information technology, which will positively affect the work of business entities. The creation of a single market for information and computer services is still relevant, which will also become an incentive for the development of information technologies and related markets.

The rule-making aspect is expressed in the fact that the change in the legislation governing relations in the field of creation, processing, storage and transmission of information gives particular relevance. Therefore, it is necessary to create prerequisites for the gradual harmonization of legislation, as well as to use positive foreign experience in legal regulation.

Setting the task. In modern conditions of development of organizational and managerial relations, information plays an important role in the process of managing the socio-economic activities of economic entities.

In the dictionary of S.I. Ozhegov this category is defined as "... a message about the state of affairs or the status of something." According to the theory of communication networks, information - is "... data about a certain object, designed with the help of one or another " language " in the form of a message or in any other form, and having signs of beginning and end".

Information as a management tool, features of its distribution and use were examined by R. Coase, J. Hodgson.

N. Wiener in his studies defines information as "... content obtained from the external environment in the process of our adaptation to it. In the control process, the information received by the central device from the original information is processed. Subsequently, the converted information is transmitted to various parts of the system, where the elements are perceived as an order".

I.M.Dzyaloshinsky defined the information space as "the space of information relations, which is created by the subjects of the information process, and having a special quality that is absent from them.

E.P. Prokhorov noted in his scientific works that "... information space provides conditions for equal opportunities for access to information resources for consumers of information on the basis of their orderly receipt and exchange".

In his turn, A.B. Averkiev said "... I considered the management information space within the enterprise to be the totality of the information database and the ways of organizing it, allowing making managerial decisions, as well as analyzing, monitoring and regulating the financial and economic activities of the enterprise".

At the same time, in existing publications and scientific developments, the issue of using information technologies in the management system is mainly considered as a whole, without studying the problems of implementing the managerial concept of informatization as an actual phase in the life cycle of economic systems.

The purpose of the research is to study the processes of interaction between information technology as a complex of software and hardware, and management as a management tool, as well as the definition of criteria that characterize information technology as a modern management category to reflect the level of their development and penetration into the system of modern management of economic systems.

Research Methodology. The degree of centralization of the technological process shows the possibilities for management not only at production facilities, but also within the framework of administrative activities [7]. This aspect is touched upon in works by A.V. Volokitin, considering the informatization of state institutions and commercial enterprises, as an opportunity to improve the efficiency of the management system. At the same time, there is a need to take into account such an aspect as the scale of the enterprise, on which not only the possible degree of centralization will depend, but also the need to calculate the economic efficiency of implementing information systems [1].

The type of entrepreneurial activity significantly affects the degree of information technology use. In the presented classification, primarily those types of activities that cannot exist without IT at present are highlighted. Financial, insurance, banking activities require taking into account a large number of factors. Among the main ones, legal and tax conditions of work, inflation, changes in exchange rates and behavior of competitors can be noted. Software tools can not only calculate various solutions quickly, but also do it accurately, which avoids errors due to the human factor and enables the manager to make managerial decisions as quickly as possible taking into account the conditions of uncertainty.

Moreover, in management it is necessary to understand that the introduction of information technologies and systems can entail significant changes in the organization. It is important to correlate the management system and new technologies from the point of view of the theory of

organization that can affect the functioning of the enterprise organization both positively and negatively.

The technical presentation allows studying the process of combining capital, information technology and labor in a large number of enterprises, at the same time, the behavioral model makes it possible to see the direct impact of these technologies on the internal work of the organization [8].

From the point of view of the development of economic processes, modern information technologies are tools that can replace human capital.

Thus, we can conclude that information technology affects the change of goals, services, actions, products or factors that can provide a competitive advantage with the ability to change the business model of the organization.

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Such a close relationship between information technology and the management of a modern enterprise makes it possible to assert that IT is a management category no less than even the structure of an organization. Any technology introduced in production, regardless of its belonging to the technical or informational side of the process, becomes a catalyst for changes that affect all areas of the company. At the same time, with each new round of informatization, a new level of information use for a further development of technology is required.

From the standpoint of the indicated role of information technologies, it is also necessary to pay special attention to the issue of their legal regulation, since they are used not only in management, but they are also production products themselves, their implementation, maintenance, improvement is the provision of services, which requires certain legislative restrictions. Moreover, information technologies are used not only by enterprises, but also by states, which raises certain issues of ensuring information security at various levels. It is advisable to identify a number of criteria that define information technology as a managerial category (Figure 1).

Information technology is designed to receive, process, store and transmit information. Therefore, according to scientists, for the possibility of legal regulation, the information is to have certain legal properties:

- “physical inalienability - it is impossible to separate information from its material medium;
- isolation - information for civil circulation opportunities is used in the form of signs and symbols, due to which it is isolated from the manufacturer and exists separately;
- dual unity of information and media - information is represented by a thing on a tangible medium;
- replicability - information has the ability to distribute an unlimited number of copies without changing the content";
- organizational form - a document containing signs and symbols expressing information;
- instance - the existence of information on a separate tangible medium, which makes it possible to keep records of the number of copies.

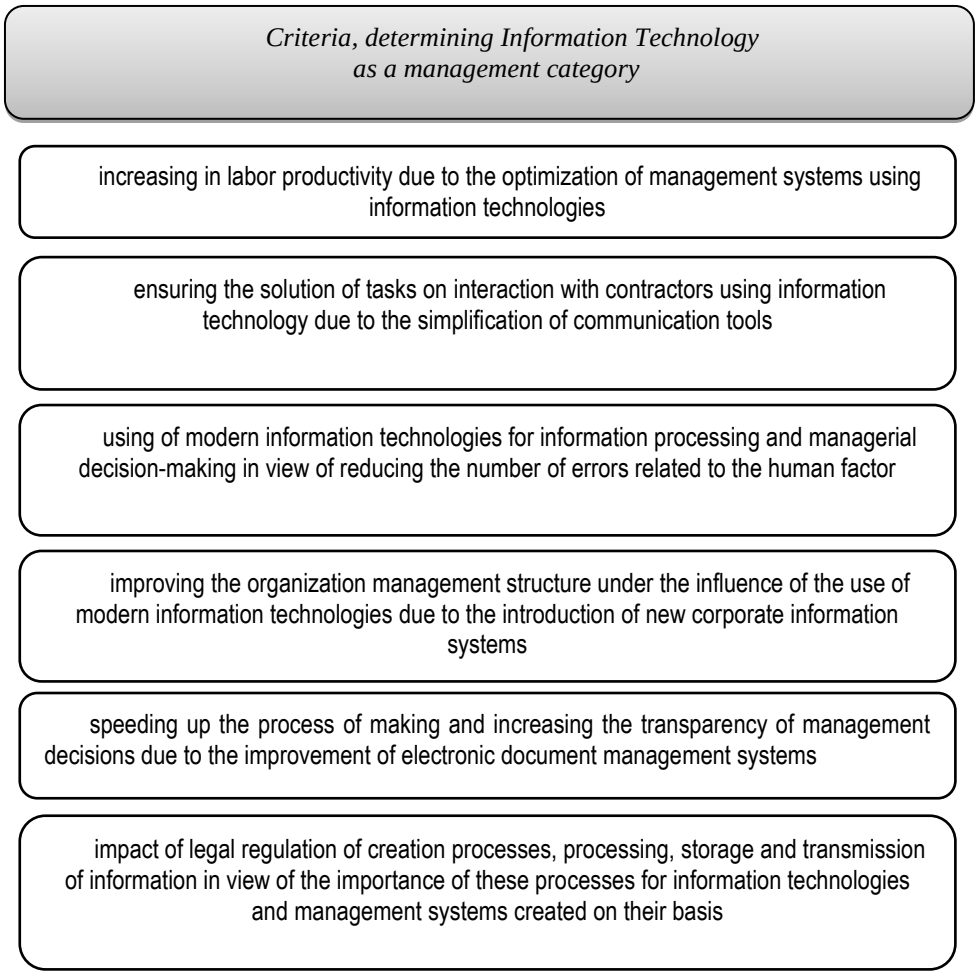


Figure 1 — Criteria, determining Information Technology as a management category

Based on the legal properties of the information, it is possible to note the possibility of legal regulation of relations arising from its creation, processing, storage and transmission. At the same time, information relations do not emerge separately, but as a part of other relations in the field of economics, management, international cooperation and others. The use, storage, transmission of information is regulated by separate legislative and regulatory acts, which establish rules of access, restrictions and the procedure for dissemination.

Results. When analyzing information technologies, the question arises - what is considered as an objective source of data in this area. The statistics used can be often overestimated or, conversely, underestimated, which can give an incorrect idea about the object under consideration. A.E. Sahak, E.V. Pakhomov and V.N. Tyushnyakov believe that the application of the method of expert assessments may be optimal for displaying the state of development of information technology [9].

Researchers such as Bruno Lanvin note that a rating has been developed to assess the level of development and application of information technology, such as the Global Information Technology Report, annually released by the organizers of the World Economic Forum in Davos since 2001 [4].

First of all, you need to understand the rating structure and criteria used by experts in the Networked Readiness Index. Four aggregated indicators are used: environmental sub-index, readiness sub-index, utilization sub-index, impact sub-index. They, in turn, consist of ten indices, which consist of indicators that are evaluated by a seven-point system (some in the range from 0 to 1).

The environmental sub-index reflects indicators related to issues of state regulation and consists of two indices: political and regulatory environment, business and innovation environment.

1. Political and regulatory environment - reflects the state of legal environment in the country associated with the work of the following components:

a) efficiency of law enforcement;
b) regulatory framework in the field of information technology;
c) autonomy of the judiciary;
d) protection of intellectual property;
e) level of pirated software;
e) number of procedures to enforce the contract;
g) time for the enforcement of contracts.

2. Business and innovation environment - reflects the state of the corporate culture of business, the level of information technologies expressed in the following indicators:

a) use of digital technology;
b) investment opportunities;
c) tax burden;
d) time interval for opening a business;
e) number of procedures for starting a business;
e) intensity of local competition;
g) level of coverage of tertiary education;
h) quality of management schools;
i) purchase of advanced technological products.

The readiness sub-index reflects indicators related to issues of using information technologies and consists of three indices: infrastructure and digital content, accessibility, and skills.

3. Infrastructure and digital content - reflects the opportunities for using information technologies related to the following indicators:

a) electricity production;
b) mobile network coverage;
c) international Internet bandwidth;
d) secure internet servers.

4. Accessibility - reflects the state of the cost of communication means and competition in the market associated with the work of the following indicators:

a) mobile cellular tariff;
b) fixed broadband Internet tariffs;

c) competition index in the Internet and telephony sectors.

5. Skills - reflect the level of knowledge of country citizens in the context of the following indicators:

a) competitiveness of domestic education;

b) quality of the secondary education system;

c) adult digital literacy rate.

The sub-index use reflects indicators related to issues of using information technologies by various actors and consists of three indices: individual use, business use, government use.

6. Individual use - reflects the state of use of communication means associated with the work of the following indicators:

a) subscriptions on mobile cell phones;

b) Internet users;

c) households with personal computer;

d) households with Internet access;

e) fixed broadband internet subscriptions;

e) cross-platform subscriptions;

g) use of virtual social networks.

7. Business use - reflects the state of the cost of communication means and competition in the market associated with the work of the following indicators:

a) level of technological use;

b) opportunities for innovation;

c) patent applications for ICT;

d) use of ICT for one-on-one transactions;

e) use of the Internet for commercial transactions;

e) degree of personnel training.

8. State use - reflects the prospects of IT development from the point of view of the country and is associated with the work of the following indicators:

a) importance of ICT for the state vision of the future;

b) e-government;

c) government policy in promoting ICT.

The impact sub-index reflects indicators related to issues of information technology development and consists of two indices: economic impact, social impact.

9. Economic impact - reflects the impact on the emergence of new information technologies related to the work of the following indicators:

a) impact of digital technology on innovation;

b) PCT ICT patent applications;

c) impact of ICT on new organizational models;

d) employment in high-tech activities.

10. Social impact - reflects the possibilities of access and participation of the population in the information technology use, represented by the following indicators:

a) impact of ICTs on access to basic services;

b) Internet - opportunities in educational institutions;

c) digital technologies in state and municipal government;

d) index of electronic participation.

The Networked Readiness Index is informative due to the combination of legal, economic, social and technological criteria, while most other indexes are focused on one criterion. However, the Networked Readiness Index was developed in 2000, which requires its transformation in connection with the changing technological and social conditions of the development of society.

The criterion “electricity production” of the “infrastructure and digital content” index of the sub-index readiness shows the number of kwh* of electricity that are generated per year per person in the country. It should be noted that, due to the widespread dissemination of information technology, the need for electricity, both of individual households and enterprises, has increased significantly [6]. Therefore, there is a threat that, when the power supply is cut off, all information resources cease to exist and a significant area of both state administration and the production sphere may be irretrievably lost [3].

For this reason, it is proposed to transform this rating criterion into "energy efficiency", which can be measured using the expert assessment method on a scale of 1 to 7. Thanks to this change, it is possible to solve a number of problems related to the energy sector:

- improving the system for managing the production and consumption of electricity;
- loss of electricity when transmitting it over significant distances;
- increase in energy consumption caused by the use of modern information technologies;
- decrease in the volume of proven energy reserves.

Such a criterion as the “mobile cellular tariff” of the “availability” index of the sub-index readiness also, from our point of view, needs to be improved. The reason is the gradual transition of the population to communication technologies using social networks and a number of programs, such as WhatsApp or Skype, which require Internet connection to work, which makes it possible to make not only calls, but also communicate using video communications [11]. Now it is priced in dollars per minute. In addition, at the moment there is a tendency to a gradual rejection of per-second tariffication [5].

The transformation of this criterion into “communication opportunities” is with the assessment of the mobile communication coverage and the Internet from the total area of the country. This approach will allow to transfer the criterion from a financial understanding of the accessible environment to the essential, which will show the possibility of using information technologies in the country as a whole. This change will help reflect trends such as:

- universalization of communication services;
- creation of gadgets with a wide range of possible means of communication;
- need to cover the largest percentage of the country's population with information technologies.

Along with the improvement of existing criteria, proposals were developed for the introduction of new ones that may be useful for assessing the state of information technology.

It is proposed to introduce the criterion "level of computer literacy", which will be measured in % of the total literate population of the country. Computer literacy, from the point of view of the state, means the presence of skills in the independent use of information technology for the interaction of an individual or legal entity with state bodies.

This indicator can be adopted to address the issue of citizen participation in the digitalization of

the economy, which allows us to solve a number of existing issues:

- reduction of physical workflow;
- automation of public services;
- ability of foreign citizens to interact with state authorities of the country of current or prospective stay;
- ability of foreign citizens to interact with government agencies.

In turn, the unit of measure is proposed on the basis that a person who does not have general literacy, with a high degree of probability, will not have computer literacy, which means there is no possibility for them to participate in certain information environment.

We believe that this indicator - the level of computer literacy - can become part of the "skills" index of the readiness subindex, since, based on the proposed semantic premise, it reflects person's ability to interact with the country using ICT.

It is also proposed to introduce the criterion "interconnection of information systems", which will allow to evaluate the degree of work of state information systems and their interconnection. This criterion will allow you to focus on issues such as:

- insufficient level of information exchange between government bodies;
- providing incomplete information;
- incomplete implementation of a number of state programs and projects;
- failure to achieve state development targets.

It is proposed to make an expert assessment of this indicator using a rating system from 1 to 7, which will enter this indicator into the rating in a harmonic way and provide an opportunity for its use.

The need for this criterion is due to the fact that the information systems of state bodies can be very different from each other. This is due primarily to the fact that they were created at different times and by different units. In the Russian Federation, the databases of the STSI and the Federal Tax Service are combined to a small extent. There are often cases when a person receives a letter from the Federal Tax Service about the debt on the payment of transport tax on movable property, which is no longer their property, and the new owner allows late payments. In such cases, the situation can be resolved only through personal requests of the previous owner, however, in practice, such letters can continue to come.

Such situations not only complicate the citizens' lives and are the reasons for the loss of a large amount of time for both the injured party and employees of state bodies, but also show the imperfection of the information transfer between various government bodies.

Of course, this approach creates risks that hacking one password can provide cybercriminals with access to all information about a person, however, there are mechanisms to protect this information that can help avoid such situations.

So, in the Russian Federation, the state defense order system was successfully implemented, which made it possible to provide instant communication with all technological chains from the customer (Ministry of Defense of the Russian Federation), the manufacturer, and to the designer of specific equipment items, which made it possible to increase the efficiency of its execution from 65% in 2012 to 85% in 2016 [2]. And this result became possible with the help of modern information technologies, which allowed to increase the speed of managerial decision-making significantly throughout the production chain.

We believe that this indicator - the interconnection of information systems - can become part of the "state use" index of the use sub-index, since, based on the above arguments, it reflects the degree of effective use of information systems.

As part of the proposed changes and additions to the Networked Readiness Index, the question arises of how much the structure of the index and the assessment methodology will change. It should be noted that the experts of the World Economic Forum in Davos developed a flexible rating system, which is expressed both in numerical, relative and expert estimates, which, after calculations, make up a single value of indices and sub-indices.

In general, the proposed changes will not seriously affect the position of countries in this index or the change in aggregate estimates at the sub-index level, but they will help to more fully highlight aspects whose development seems most necessary for the development of a digital economy.

In the future, we see the creation of separate Information Technology Development Index for the EAEU countries. For these purposes, it is proposed to take a different approach to covering the further development of information technologies.

State subindex - will reflect the state of processes regulated by the state and their impact on the development of information technologies.

1. Political and legal environment - will reflect the state of the legal environment in the state associated with legal regulation and state policy in the field of IT.

2. Educational environment - will reflect the quality indicators of the education system, the state of IT in schools, the level of general and computer literacy, and the level of training of managerial personnel.

3. E-government - will reflect the opportunities for citizens to use public services using unified methods of access to the combined databases of government agencies.

Infrastructure and technology subindex - will reflect the state of information technology use by individuals and legal entities.

4. Individual environment - will reflect the level of modern information technology use by users, as well as the volume of subscriptions on various portable devices.

5. Corporate environment - will reflect the level of information technology use for the purpose of conducting business processes.

Business subindex - will reflect indicators related to the conduct of the business and its information technology use.

6. Innovative environment - will reflect the level of implementation of information technology in enterprises and indicators on which the ability to do business depends.

7. Technological environment - will reflect the level of information technology use within corporations and their impact on the development of new services and products.

From our point of view, this approach will allow us to assess the impact of each of the sectors (government, infrastructure and technology, business) on the development of information technology as a whole, as well as each sector separately.

The reason for creating State subindex is as follows:

- state performs the regulatory function in the field of information technology, through legal and technical regulation;

- state determines the policy in the field of the development of priority information technologies

by creating maximum favoring regimes for certain types of entrepreneurial activity within the framework of special economic zones;

- state determines the parameters for the protection of information technologies and information security by adopting regulations in the field of information protection and developing national standards for creating critical infrastructure;

- state creates opportunities for electronic interaction of individuals and legal entities with public authorities by implementing e-government programs and strengthening the relationship between information systems of various departments.

The reason for creating Infrastructure and technology subindex is as follows:

- availability of access to modern means of communication affects the ability of individuals and legal entities to act as business entities in connection with significant distances between contractors within the EAEU;

- use of pirated information technologies affects not only the state of the IT market, but also information security systems, creating a threat not only to individual personal users, but also to entire industries;

- competition in the field of communication technologies leads to their further development and the possibility of obtaining competitive advantages for enterprises and sectors of the country's economy.

The reason for creating Business subindex is as follows:

- enterprises independently make management decisions on the implementation of certain information technologies, which directly affects their development;

- company is interested in obtaining competitive advantages, which allows it to form an order for the creation of new information technologies, which is reflected in the activities of IT companies;

- company focuses on modern information technologies to create new services and products that would meet the needs of consumers;

- company changes its organizational model under the influence of new management systems that are based on information technologies.

Conclusions. It was determined that the EAEU Information Technology Development Index is a promising integral indicator for assessing the state of the IT environment and finding benchmarks for improving the state of the information and computer services market. At the same time, the use of data from the Eurasian Economic College will be more objective, as it will be based on statistical indicators of the member countries of the economic association. It is necessary to remove legal barriers quickly that block the use of new technological solutions. Identification and removal of legal barriers should be one of the services provided to businesses through information solutions.

Tools for solving this problem can be:

- mechanisms for involving representatives of all ecosystem participants in the assessment of the regulatory and actual impact;

- algorithms for collecting and processing data on economic and other activities that open up new opportunities for identifying defects in legal regulation.

Modern information technologies not only require new regulatory approaches. They also open up new opportunities for working with regulatory material, and the digital transformation of economic processes, among other things, should change the rulemaking practice in order to increase the speed of regulatory decisions and improve the quality of regulation.

The result of the study is the possibility of practical application of the directions of development of information technologies in the management system of economic systems at various levels.

Directions for further research. The processes of globalization of the economy and the information revolution have given impetus to the development of a new form of economic relations in the world - digital. Changes in the digital economy create new business rules for manufacturers and buyers, in this regard, business entities need to pay attention to the formation and development of digital competencies, and government authorities to promote the spread of digital technologies and increase their competitiveness on the world stage.

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